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T. Kobayashi and M. Sasaki

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Tokimasa Kobayashi and Masayoshi Sasaki

Kaisan Kaiyo Kenkyukaiho

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## Characteristics of recent herring fishing conditions in Hokkaido

It has already been reported that signs are seen recently which indicate changes in the herring stock conditions on the west coast of Hokkaido (Kobayashi, 1986). In the present report we will present some of the characteristics noted in the recent herring fishing conditions.

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1. The amount and compositions of the catch

The Hokkaido-Sakhalim herring (spring herring) which had been caught in the amount of 970,000 tonnes in 1897 kept declining in volume with recurring changes in the stocks. From 1959 the volumes of catch in the coastal waters of Hokkaido amounted to zero. Later fishing operations in the area covering the Ishikari Bay, Saromako and such which extends from the Sea of Japan side to the Sead of Okhotsk targeted spawning shoals of herring not belonging to the above phyletic group, but except for the 835 tonnes of 1964, the level of catch declined to less than 100 tonnes per year. Aside from these activities, the offshore trawlers operate mainly on the Sea of Okhotsk side during the early wintering period from December to January around which time the ice floes come in contact with the coast and during the early spawning period going from March to June. Although the amount of catch including the catch in the Sea of Japan reached 19,000 tonnes in 1982, the volume dropped to a little more than 4,000 tonnes in 1985 (Table 1).

Under these conditions, there occured in the coastal waters of the Ishikari Bay in May 1985 a large incoming herring migration the size of which had not been seen in recent years (Kobayashi, 1986). Later, one observed in June in the Rumoi and Soya areas, in July in Omu, Yubetsu and such on the Sea of Okhotsk side other incoming migrations. Such appearances of herring shoals in wide-ranging coastal areas had not been seen since the days of the Hokkaido-Sakhalim herring decline. The volume of catch was about 4,500 tonnes in the coastal areas and reached a peak after 1955.

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Meanwhile, in the offshore areas on the Sea of Japan side (northern grounds) and on the Sea of Okhotsk side (eastern grounds) active fishing by trawlers started from November. The size of the fish caught (caudal fork length) in the coastal area was 16.22 cm. The shoals consisted mainly of immature fish 2 years of age (1983 class group) (Fig. 1). In the offshore areas, the age composition of the catch was roughly similar to that of the catch in the coastal areas.

Thereafter in 1986 too, one observed similar incoming herring migrations extending from the northern Sea of Japan (Ishikari Bay and Rumoi, Soya, Abashiri areas) to the Sea of Okhotsk side. The estimated catch volume was about 1,500 toones on the Sea of Japan side, and roughly 1,200 tonnes on the Sea of Okhotsk side.

On the other hand, the volume of catch by the offshore trawlers reached 17,000 tonnes on the Sea of Japan side and 52,000 tonnes on the Sea of Okhotsk side. If one adds the catch volume in the coastal areas, the total exceeds 70,000 tonnes. This represents the highest level in recent years with respect to volume of catch within the 200 nautical miles of Japan. The size of the fish caught was 19-25 cm. The 1983 class group ( 3 year old fish) which constituted the main group in the previous year, represented at least 90% of the catch, and was followed by the 1982 class group (4-year old) (Fig. 1). The 4-year old fish were virtually mature. Amoung the 3-year old fish one noted degrees of maturity differing according to the area. In the Ishikari Bay, about 10% were mature and in the Rumoi, Soya areas, 10-30% were.

In 1987 also, like in the previous year, there were incoming herring migrations in the area extending from the Ishikari Bay on the Sea of Japan side to the vicinity of Yubetsu on the Sea of Okhotsk side. These took place from late April to June. Yet the maturity level of the catch differed from those of the two former years. Most fish were mature individuals having come to the coast to spawn. The catch volume in this coastal area was 1,700 tonnes for the Sea of Japan side and roughly 700 tonnes for the Sea of Okhotsk side and these volumes were estimated to be more or less in line with the former year. The catch volumes of the offshore trawlers are at this moment advancing at level representing less than half the amount for the same period of the previous year. As for the size range of the fish caught in the coastal areas, it was 2-3 cm. longer than in the previous year. With regard to age composition, the 4-year old fish (1983 class group) dominated to be followed by the 3-year old fish and lastly the 5-year old (Fig. 1).

Thus from 1985 on the volume of herring catch along the coasts and offshore increased in the Hokkaido area extending from the Sea of Japan side to the Sea of Okhotsk side and has in recent years reached a high level. One noted also an increase in parent fish coming to the coasts to spawn. Seaweeds and fishing gear on which herring eggs had been laid were observed in areas where nothing of the kind had been observed for about 30 years. This indicates a tendency toward a geographical widening of the spawning grounds.

As for the yearly variations of the age compositions of the catch, we see that the 1983 class year is dominant (Fig. 1). The occurrence

of such dominant year class group is one of the signs of the recovery of the herring stocks. The continuing abundance of the 1984, 1985 class groups is presently estimated not to be on so high if looked at from the appearance volume viewpoint. To achieve a substantial recovery of the herring stocks, several dominant year class groups must be formed in addition to the 1983 class group. One may expect an increase in the number of spawning parent fish in 1987 and the visit to the shores of the 1983 class group which from next year will have become spawning parent fish. This is why one will watch the volumes of occurrence of the groups following the 1986 class group as they constitute the determining factor regarding the future directions taken by the stocks.

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2. The phyletic groups

The interest is increasing as to which phyletic groups have produced the increased catch volumes over the recent years. According to past phyletic groups studies, there are several groups distributed in the area extending from the Sea of Japan side to the Sea of Okhotsk side. There are for instance the Ishikari Bay herrings, the Saromako herrings, the Notoroko herrings. While some groups show a strong regional ecology, others are active over a wide migration range. The Okhotsk Sea herring (provisional appellation) is believed to spawn mainly at Sakhalin. The Hokkaido-Sakhalin herrings have also been

reported (Yamaguchi, 1926; Fujita-Kokubo, 1927, Furrorov, 1950; Irie, 1980, Sugano 1982; Kobayashi 1983). So, one started examining the characters of 23 specimens (Fig. 2) collected from 19 sites along the coasts as well as from offshore areas of the Sea of Japan and of Okhotsk. These characters are for instance the biochemical genetic variations (isozymes), the number of spinal vertebrae. Other things examined were the scale phases and growth patterns, and one compared the characteristics of the above groups.

As a result, it was demonstrated with regard to most immature fish appearing in both years 1985, 1986 as well as with regard to most 4-year old fish of 1987 that all Ishikari Bay herrings, Saromako herrings, Notoroko herrings, Sea of Okhotsk herrings had different biochemical characteristics. Furthermore, their morphological characteristics agree well with those of the Hokkaido-Sakhalin herrings of the past. This is why they are very likely to be Hokkaido-Sakhalin herrings. There are however differences as the spawning season is somewhat later and as there is a certain percentage of individuals whose scale pattern is unclear. Moreover, as there are no data of the time comparing the isozyme variations, it is impossible to determine for sure whether the present specimens are Hokkaido-Sakhalin herrings, and one should conduct further examinations of the phyletic groups.

表1　北海道の日本海側及びオホーツク海側におけるニシン漁獲量（トン）の経年変化

| a 年 | b 日本海 | | | c オホーツク海 | | | 合計 |
|---|---|---|---|---|---|---|---|
| | d 沿岸 | e 沖合 | f 計 | d 沿岸 | e 沖合 | f 計 | |
| 1977 | 143 | 113 | 256 | 168 | 7,640 | 7,808 | 8,064 |
| 1978 | 21 | 77 | 98 | 74 | 3,221 | 3,295 | 3,393 |
| 1979 | 32 | 43 | 75 | 1,122 | 3,611 | 4,733 | 4,808 |
| 1980 | 31 | 94 | 125 | 386 | 9,158 | 9,544 | 9,669 |
| 1981 | 58 | 222 | 280 | 157 | 7,737 | 7,894 | 8,174 |
| 1982 | 266 | 1,943 | 2,209 | 1,314 | 16,936 | 18,250 | 20,459 |
| 1983 | 245 | 2,254 | 2,499 | 112 | 4,894 | 5,006 | 7,505 |
| 1984 | 490 | 265 | 755 | 288 | 4,618 | 4,906 | 5,661 |
| 1985 | 1,795 | 1,919 | 3,714 | 2,703 | 2,219 | 4,922 | 8,636 |
| 1986 | 1,500* | 17,246 | 18,746* | 1,200* | 52,153 | 53,353* | 72,099* |
| 1987** | 1,700 | — | — | 700*** | — | — | — |

g) 1985年までの沿岸の集計値は北海道統計情報事務所調べ，沖合は北海道沖合底びき網漁業漁場別漁獲統計年報による。
* 推定値，** 1月から6月までの推定値，*** 網走地方を除く推定値

Table 1 yearly variations in the volume of herring catch (tonnes) on the Sea of Japan and Sea of Okhotsk sides of Hokkaido

a) year
b) Sea of Japan
c) Sea of Okhotsk
d) coastal waters
e) offshore
f) total

g) up to 1985, the collected values of coastal catch are based on the surveys made by the Hokkaido Statistics and Information Bureau, and the values of the offshore catch on the annual reported statistics for catch in the various trawling grounds offshore Hokkaido.

* estimate

** estimate from January to June

*** estimate excluding the Abashiri area

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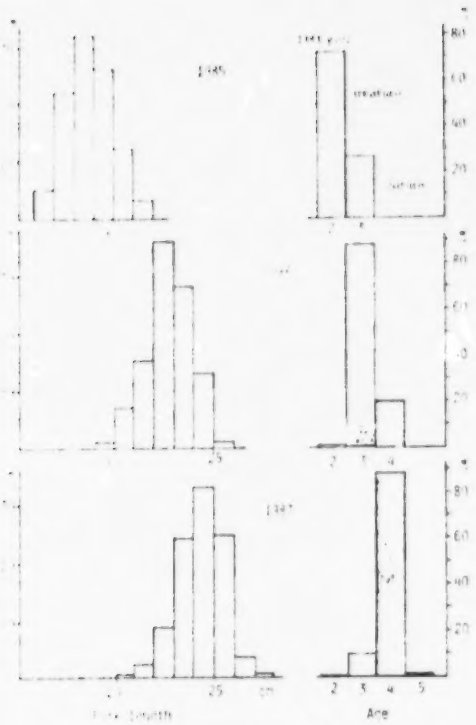


図1　日本海の沿岸域で漁獲されたニシンの標本体長組成と年齢組成の経年変化。年齢組成の斜線部分は成魚を，白抜きの部分は未成魚を示す。

Fig. 1　Annual changes in the size and age compositions of the herring caught in the coastal waters of the Sea of Japan.　The etched part in the age composition represents the mature fish and the white portions represent the immature fish.

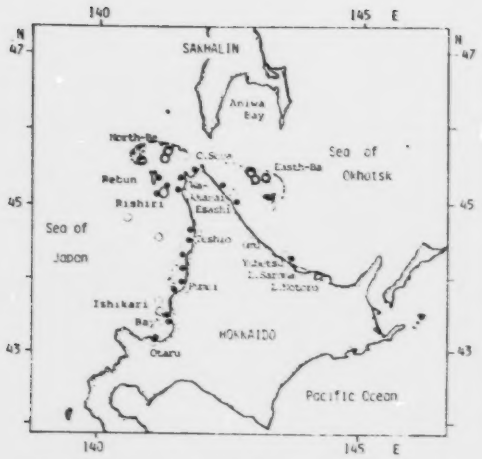


図2　1987年のニシン漁場分布，及び標本採集地点。産卵親魚が漁獲された水域を黒丸，標本採集地点を白丸，また主要な沖合底びき網漁場を斜線部分で示した。

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Fig. 2　Distribution of the herring fishing grounds and the sites of specimen collection in 1987. The black dots indicate the areas where the spawning parent fish were caught. The white circles indicate the sites where the specimens were collected, and the etched portions indicate the main offshore trawling grounds.

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* translator's note: reading not quite certain